



May 2015

## ICMI GOLD MINE RECERTIFICATION AUDIT - SUMMARY AUDIT REPORT

# Gold Fields Tarkwa Plant

**Submitted to:**

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REPORT



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## 1.0 SUMMARY AUDIT REPORT FOR GOLD MINING OPERATIONS

<b>Name of Cyanide User Facility:</b>	Tarkwa Gold Plant
<b>Name of Cyanide User Facility Owner:</b>	Gold Fields Limited
<b>Name of Cyanide User Facility Operator:</b>	Gold Fields Ghana Limited
<b>Name of Responsible Manager:</b>	George Nutor – Manager Metallurgy
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## 2.0 LOCATION DETAIL AND DESCRIPTION OF OPERATION

Tarkwa Gold Mine, is majority owned and operated by Goldfields Ghana Limited

(90%) and the Ghanaian Government (10%). It is situated in the Western Region of Ghana, approximately 350km by road from the capital, Accra. Site conditions are tropical with annual rainfall of approximately 2,000 mm and temperature ranging between 25°C and 35°C.

In June 1993 the Government of Ghana entered into an agreement with Gold Fields Ghana for the operation of the mine by Gold Fields Ghana Limited (GFGL) under a management contract. Goldfields Ghana Limited developed a heap leach surface mining operation. The initial development, Tarkwa Phase 1, was completed in April 1998 processing 4.7 Mtpa heap leach feed ore. An expansion, Phase 2, was completed in July 1999 increasing ore production to the heap leach to 7.2Mtpa. Process improvements and optimisations resulted in the throughput increasing to 9.4Mtpa. In August 2000, GFGL acquired the northern part of the Teberebie lease.

These facilities increased ore production to the heap leach to 16Mtpa. The north heap leach has had a number of pad expansions, the latest Phase 5, to enable current production capacity to be sustained.

Heap leach operations are carried out at two main locations designated as the North and the South sections. At the South, ore is crushed down to a size of 9mm through four stages of crushing, while at the North, ore is crushed down to a size of 80% passing 12mm through 3 stages of crushing. Prior to placement on the heaps, the ore is agglomerated using cement and lime to minimize the migration of loose fines into the heap as well as subsequent blocking of drainage channels. Cyanide solution is added on the top of the heap through dripper tubes and percolates through the heap dissolving the gold particles. At the end of the percolation cycle, the pregnant solution is pumped to the Adsorption Desorption Recovery (ADR) plants (one each at South and North) where the soluble gold is adsorbed onto activated carbon. At both plants, the gold is recovered by an elution and electrowinning process.

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Barren solution exiting the adsorption plant is upgraded with cyanide and returned to the heap leach pads to recommence the leach cycle. Eluted carbon is thermally regenerated prior to return to the adsorption tanks. The heap leach cycle extends for up to 280 days before all the extractable gold has been recovered.

Cyanide addition ceased on the south heap leach in October 2012 with leaching continuing for a period thereafter. The south heap leach is currently being decommissioned. The north heap leach cyanide addition ceased in September 2014. The mixing facility for the north heap leach has been decommissioned although leaching is still taking place.

The Tarkwa CIL plant was commissioned in October 2004 and utilised a single SAG mill, designed to mill 4.2mtpa (525tph). Through the installation of a Ball Mill, along with additional upstream and downstream equipment, the plant has now be expanded to 12mtpa (1,500tph). Tailings from the plant is deposited on the Tarkwa tailings storage facilities (TSF's), which are a paddock type impoundments located approximately 3.0 km north west of CIL plant site and immediately due south of the existing North leach pads. All of the ore is now processed through the CIL.

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## SUMMARY AUDIT REPORT

### Auditors Findings

**Gold Fields Tarkwa Gold Plant is:**  in full compliance with **The International Cyanide Management Code**

in substantial compliance with

not in compliance with

**Audit Company:** Golder Associates Africa (PTY) Ltd

**Audit Team Leader:** Ed Perry, Lead Auditor

**Email:** [eperry@golder.com](mailto:eperry@golder.com)

Tarkwa Gold Plant has not experienced any significant cyanide incidents or compliance problems during the previous three year audit cycle.

Principle 5 of the Protocol includes the requirement to show that the operation has developed an estimate of the cost to fully fund third party implementation of the cyanide-related decommissioning measures as identified in its site decommissioning or closure plan. In order to demonstrate compliance with this Principle the Costed Mine Closure and Reclamation Plan 2014-2017 Tarkwa Gold Mine, dated February 2014, Golder Associates needed to be reviewed. Since the Closure and Decommissioning Plan had been written by staff from Golder Associates it was deemed that there may be a conflict of interest having staff from Golder Associates review this document as part of this audit. Therefore, an independent auditor (Mark Montoya) from Visus Consulting Group Inc. who is also a pre-certified ICMI auditor was employed to review the Closure and Reclamation Plan to determine compliance with this requirement in Principle 5.

### Name of Other Auditors

Romain Girard, ICMI pre-certified Mine Technical Specialist; and  
Mark Montoya, ICMI pre-certified Lead Auditor and Mine Technical Specialist.

### Dates of Audit

The Re-certification Audit was undertaken between 6 October 2014 and 10 October 2014.

I attest that I meet the criteria for knowledge, experience and conflict of interest for Code Verification Audit Team Leader, established by the International Cyanide Management Institute and that all members of the audit team meet the applicable criteria established by the International Cyanide Management Institute for Code Verification Auditors.

I attest that this Summary Audit Report accurately describes the findings of the verification audit. I further attest that the verification audit was conducted in a professional manner in accordance with the International Cyanide Management Code Verification Protocol for Cyanide Production and using standard and accepted practices for health, safety and environmental audits.

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# ICMI CYANIDE RE-CERTIFICATION AUDIT - SUMMARY REPORT

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**PRINCIPLE 1 – PRODUCTION**

**Encourage Responsible Cyanide Manufacturing by Purchasing from Manufacturers that Operate in a Safe and Environmentally Protective Manner**

**Standard of Practice 1.1: Purchase cyanide from manufacturers employing appropriate practices and procedures to limit exposure of their workforce to cyanide, and to prevent releases of cyanide to the environment.**

in full compliance with

The operation is

in substantial compliance with

**Standard of Practice 1.1**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 1.1; to purchase cyanide from manufacturers employing appropriate practices and procedures to limit exposure of their workforce to cyanide, and to prevent releases of cyanide to the environment.

Orica's West Africa Supply Chain covers the transportation of solid sodium cyanide from the certified Yarwun production facility to the Port of Brisbane (Australia) and from there via the Mediterranean Shipping Company to the Ports of Tema and Takoradi (Ghana), Conakry (Guinea), Dakar (Senegal), Nouakchott (Mauritania). Cyanide is then transported by road to various mine sites within West Africa by Code certified transporters. Within Ghana, some solid sodium cyanide is transported from the Port of Takoradi by road to Orica's Tarkwa cyanide transfer facility, with subsequent road transportation to various mine sites within West Africa by Code certified transporters. Orica's Yarwun production facility was recertified on 29 October 2013.

Samsung is an independent distributor of cyanide sourcing sodium cyanide briquettes from a certified producer Tongsoh production facility - certified 11 March 2014 under the ICMI code. Samsung Africa Supply Chain includes the Port of Pusan, South Korea, ocean transport by shipping companies MSC, Maersk and Safmarine, the Ports of Takoradi and Tema, Ghana, Conakry, Guinea, Dakar, Senegal and Mombasa, Kenya, and Dar Es Salaam, Tanzania, Vehrad Transport and Haulage Ltd's repackaging operation in Tema, Ghana and is fully certified under the ICMI Cyanide Code (12 July 2011). Tongsoh Petrochemical Co., Ltd, production facility was certified under the ICMI code on 11 March 2014. Samsung was no longer used for the supply of cyanide after the 1 July 2014. Subsequent to this the cyanide supplied by Samsung was transported by Allship Logistics Ltd (recertified on 25 July 2013) from Takoradi Port or by Vehrad (recertification on 26 January 2015) from Tema Port. The cyanide was delivered in the shipping containers that were offloaded at the Port and therefore no repackaging was required.

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**PRINCIPLE 2 – TRANSPORTATION**

**Protect Communities and the Environment during Cyanide Transport**

**Standard of Practice 2.1:**

**Establish clear lines of responsibility for safety, security release prevention, training and emergency response in written agreements with producers, distributors and transporters.**

**in full compliance with**

**The operation is**

in substantial compliance with

**Standard of Practice 2.1**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 2.1; to establish clear lines of responsibility for safety, security release prevention, training and emergency response in written agreements with producers, distributors and transporters.

The contract with Orica includes transport and delivery of the cyanide to the mine site. Orica uses subcontractors for the transportation of Cyanide from the port of Takoradi to the mine. This includes; Barbex (until 13 June 2014 when they withdrew from the Cyanide Code), Vehrad Transport and Haulage Ltd (recertification on 26 January 2015), Allship Logistics Ltd (recertified on 25 July 2013) and currently Stellar Logistics (certified 6 March 2014).

Samsung is an independent distributor of cyanide sourcing sodium cyanide briquettes from a certified producer Tongsoh production facility - certified 11 March 2014. Samsung Africa Supply Chain includes the Port of Pusan, South Korea, ocean transport by shipping companies MSC, Maersk and Safmarine, the Ports of Takoradi and Tema, Ghana, Conakry, Guinea, Dakar, Senegal and Mombasa, Kenya, and Dar Es Salaam, Tanzania, Vehrad Transport and Haulage Ltd's repackaging operation in Tema, Ghana and is fully certified under the ICMI Cyanide Code (12 July 2011). Samsung was also used for the supply of cyanide until the new contract with Orica was entered into. Samsung was no longer used for the supply of cyanide after the 1 July 2014. Subsequent to this the cyanide supplied by Samsung was transported by Allship Logistics Ltd (recertified on 25 July 2013) from Takoradi Port or by Vehrad (recertification on 26 January 2015) from Tema Port. The cyanide was delivered in the shipping containers that were offloaded at the Port and therefore no repackaging was required.

The previous contract with Orica and Samsung and the new contract with Orica include all the ICMI requirements.

**Standard of Practice 2.2:**

**Practice 2.2:**

**Require that cyanide transporters implement appropriate emergency response plans and capabilities and employ adequate measures for cyanide management.**

**in full compliance with**

**The operation is**

in substantial compliance with

**Standard of Practice 2.2**

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not in compliance with

### Summarise the basis for this Finding/Deficiencies Identified:

The operation is in full compliance with Standard of Practice 2.2; to require that cyanide transporters implement appropriate emergency response plans and capabilities and employ adequate measures for cyanide management.

Gold Fields Ghana Limited currently obtains its solid cyanide from Orica International PTE Ltd. Contract for the Supply of Cyanide dated 1 July 2014 - 30 June 2017 was observed. The contract states in Appendix D that all third parties engaged by Orica for the manufacture, transport and use of cyanide will be a signatory to and comply with the requirements of the International Cyanide Code. The contract with Orica includes transport and delivery of the cyanide to the mine site. Orica uses subcontractors for the transportation of Cyanide from the port of Takoradi to the mine. This includes; Barbex (until 13 June 2014 when they withdrew from the Cyanide Code), Vehrad Transport and Haulage Ltd (recertification on 26 January 2015), Allships Logistics Ltd (recertified 25 July 2013), and currently Stellar Logistics (certified 6 March 2014).

The previous contracts that Gold Fields had with Orica and Samsung also required the transportation companies to be certified under the Code.

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PRINCIPLE 3 – HANDLING AND STORAGE

Protect Workers and the Environment during Handling and Storage

Standard of Practice 3.1: Design and construct unloading, storage and mixing facilities consistent with sound, accepted engineering practices, quality control/quality assurance procedures, spill prevention and spill containment measures.

[X] in full compliance with

The operation is

[ ] in substantial compliance with

Standard of Practice 3.1

[ ] not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in full compliance with Standard of Practice 3.1; to design and construct unloading, storage and mixing facilities consistent with sound accepted engineering practices, quality control/quality assurance procedures, spill prevention and spill containment measures.

Since the previous recertification audit, some changes have been made to the process and have been verified during the site inspection by the auditors. Cyanide unloading, storing and mixing is no longer being undertaken in the south (October 2012) or north heap leach areas (September 2014). Therefore the only facility for unloading and mixing cyanide at the time of the audit was the CIL external reagent area, and the storage tank within the CIL (for reagent strength cyanide).

The facilities for unloading storing and mixing cyanide have been professionally designed and constructed, as highlighted in the previous recertification report.

Since the last recertification audit, the cyanide mixing and storage tanks in the external reagent have been replaced. The replacement of the CIL mixing and storage tanks quality assurance was provided by Seedco Engineering and Construction.

It was confirmed during the site inspection that the CIL external reagent area (solid cyanide storage and mixing tank) as well as storage tank in the CIL area are located away from people and surface water. Both areas are located within a locked fenced area, and there is no surface water present in the vicinity of the area. These areas are equipped with outer drain channels that report to the CIL plant sumps.

External reagent mixing and CIL storage tanks have high-level sensors and are in a bund. Level sensors stop the water valve at that mixing tank at 85% and the level sensor stops the transfer pump from the mixing tank to the storage tank inside the plant at 85% tank level as well as automatically closing the valves to prevent syphoning.

Site inspection verified that the mixing tank in the external reagents area as well as the storage tank in the CIL area, are in a concrete bunded area as well as being located on a concrete slab providing a competent barrier to leakage.

The Auditor reviewed the Tarkwa Gold Mine QA/QC internal report on the cyanide tank replacements showing replacement of both the mixing and storage tanks with new lined ones. The fill inside the ring beam base was excavated to a depth of 75mm and filled with concrete for the mixing tank in the external reagent area and the storage tank in the CIL.

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# ICMI CYANIDE RE-CERTIFICATION AUDIT - SUMMARY REPORT

Only solid cyanide is used at the site. The solid cyanide boxes are stored in the external reagents area in a shed with two open sides providing adequate ventilation. Both the mixing tank in the external reagents area and the storage tank in the CIL area are equipped with ventilation pipes.

The cyanide boxes in the reagent area are stored under a roof, on a concrete surface and stored on wooden pallets so that they are not in direct contact with the concrete flooring.

The external reagents area where the cyanide boxes are stored and the mixing is carried out is located within a fenced and locked area with clear signage indicating that cyanide is stored in the area. There is also a security gate with guards 24 hours a day to control vehicle access prior to entrance into the reagents area. This is within the wider mine site that is also access controlled.

During the site inspection, the auditors verified that the cyanide boxes are stored separately from incompatible material, within a bunded secondary containment equipped with sump and sump pump.

The cyanide mixing and storage tanks are also located separately from any incompatible material, within their own secondary containment equipped with sump and sump pump.

**Standard of Practice 3.2:**

**Operate unloading storage and mixing facilities using inspections, preventative maintenance and contingency plans to prevent or contain releases and control and respond to worker exposures.**

in full compliance with

**The operation is**

in substantial compliance with

**Standard of Practice 3.2**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 3.2; to operate unloading storage and mixing facilities using inspections, preventative maintenance and contingency plans to prevent or contain releases and control and respond to worker exposures.

The current contracts stipulate that it is the seller's responsibility to decontaminate and dispose of used cyanide packaging material. The empty containers are kept inside the cyanide storage area, before being securely placed back in the original sea container in which they were delivered. Stella Logistics collects the sea container, transporting it to the Orica local warehouse. Orica then transports the containers to the Vehrad yard in Tema for incineration.

The procedure above as well as visual inspection shows that no containers are being used for any purposes than holding cyanide. No washing takes place on Site. No drums are used on site for cyanide containment.

The operation has developed and implemented plans or procedures to prevent exposures and releases during cyanide unloading and mixing activities.

The Auditors reviewed a set of relevant procedures and visually witnessed a mixing event, checking the implementation of the procedure by the operator performing the mixing task, as well as interview of the operators performing the mixing. These include stipulating the required PPE and stating that the stacking height limited to 2 containers high as detailed in above procedure.

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**PRINCIPLE 4 – OPERATIONS**

**Manage Cyanide Process Solutions and Waste Streams to Protect Human Health and the Environment**

**Standard of Practice 4.1: Implement management and operating systems designed to protect human health and the environment including contingency planning and inspection and preventative maintenance procedures.**

in full compliance with

**The operation is**

in substantial compliance with

**Standard of Practice 4.1**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 4.1; to implement management and operating systems designed to protect human health and the environment including contingency planning and inspection and preventative maintenance procedures.

Tarkwa Gold Mine has developed a number of procedures for the operation of cyanide facilities including general cyanide safety and handling procedures, CIL plant procedures, and heap leach procedures, TSF procedures and water treatment procedures. There are 30 general cyanide procedures, 52 CIL procedures, 22 heap leach procedures, and 6 special cyanide procedures that cover a wide range of activities linked with cyanide, including health and safety, safe operation of equipment, emergency procedures, etc.

All the reviewed procedures have been developed adequately and are being revised on a regular basis (every 2 years or as appropriate if any changes in process or other requirement), approved and detailing special requirements, hazard classification, PPE, specific tools for the job, task methodology, including potential hazards and intermediate control, next review date and review history.

The tailings dam operation manuals for TSF 1 (Knight Piesold), TSF 2 and TSF 3 (Metago/SLR) were reviewed during the audit. The heap leach operation manual (TGM internal document) was also reviewed during the audit, even though cyanide addition has now stopped on all leach operations at TGM. The operation has a number of procedures identifying assumptions and parameters for design and operation of the cyanide facilities, which were reviewed by the auditors.

Tarkwa Gold Mine is operating with a number of inspections and checklists, as well as preventive maintenance activities describing the standards and practices necessary for the sound operation of the cyanide facilities. Operational inspections are undertaken on a daily basis by operators on most facilities, supplemented with weekly inspections of TSF areas as well as monthly inspections by supervisors, Tanks thickness testing is undertaken every quarter, TSF external audit every quarter, all of which are of a frequency deemed adequate for operations

Planned maintenance also includes inspections, the majority of which are on a monthly basis. Wildlife mortality is monitored on a daily basis and recorded on the tailings dam inspection checklist. The auditor reviewed the preventive maintenance system electronically (SAP) as well as records of all inspection checklists for random dates during the recertification period.

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There is a Change Management Procedure for the mine TGM 9 14 PR Rev.1, dated 25 August 2010. The change management process includes any major additions to the mining process that is managed by the mine. Any major changes that are managed by the head office and implemented by the head office due to the size of the change. There have not been any major changes associated with the storage, mixing or processing of cyanide during the recertification period.

There are a number of procedures in place for contingencies situations such as an upset in TSF water balance, temporary closure, or when inspections or monitoring identifies a problem. The most relevant procedures were reviewed.

All tanks are thickness tested on a quarterly basis with an ultrasonic method. The auditors reviewed quarterly ultrasonic thickness testing for the following: the mixing tank in the external reagent area for 2013 and 2014; 5 tanks in the CIL area during different dates during 2012, 2013 and 2014; and south heap leach ADR cyanide tanks for 2012. The criteria is to replace the tanks when the tanks are 85% of the original thickness.

Signs of corrosion and leakage on pipes and integrity of secondary containment are addressed in the following that were reviewed: daily operating inspection and monthly supervisors inspections of the external reagent area, CIL area, and north heap leach area; and random checks performed for years 2011-2014.

Daily inspection of leach detection system at heap leach and ponds were undertaken for the period that the north and south ADR plant were operational. The auditors reviewed the inspection forms for the last 6 months of operation for the north heap leach and south heap leach areas. SAP PPMS system covers scheduled maintenance for all pumps, pipes and valves. Random checks of this were undertaken over the recertification period. Operational inspections addressed the deterioration and leakage for pipelines, pumps and valves.

The emergency power source is provided by two 2 MW gensets in case of failure or problems with the main grid (national grid GRIDCO). The CIL plant is designed to drain centrally in case of power failures and therefore no overtopping would occur in case of such failure. The genset are being tested automatically on a monthly basis (automatic start at the end of every month) and maintained on an annual basis as observed through SAP.

**Standard of Practice 4.2: Introduce management and operating systems to minimise cyanide use, thereby limiting concentrations of cyanide in mill tailings.**

in full compliance with

**The operation is**

in substantial compliance with

**Standard of Practice 4.2**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 4.2; to introduced management and operating systems to minimise cyanide use, thereby limiting concentrations of cyanide in mill tailings.

The operation conducts a program to determine appropriate cyanide addition rates in the mill and evaluate and adjust addition rates as necessary when ore types or processing practices change cyanide requirements.

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Cyanide addition control and analyse is undertaken with a TAC 2000, with measurement taken every 10 minutes. In addition, manual titration by both the production department (twice per day) and the technical department (3 times per shift) are undertaken. Titration is undertaken on common tank 0 (common tank to both circuit CIL 1 and CIL 2) and on tank 1 for both circuits. Manual titration data were reviewed for the last three months showing very little variation.

Interview with control room operator as well as floor operator indicate that there is little variation in the ore.

The Auditors observed that the set point has been between 180 ppm to 230 ppm in common tank 0 (common tank to both circuit CIL 1 and CIL 2), but showing clearly that the operation is striving to reduce the consumption, with increase in consumption only undertaken to maintain recovery (consumption needs to be increased when high solid losses as well as high grade are encountered).

The increments are always undertaken with a 5 ppm increase and monitoring data as well as process data are reviewed before a decision is made to increase the set point further. When the process data is stable, the operation strives to reduce the set point until a loss of recovery is encountered.

An interview with CIL metallurgist indicated that the absolute minimal cyanide consumption would be around 160 ppm for this plant under perfect conditions, indicating that the operation is performing well to reduce its consumption.

**Standard of Practice 4.3: Implement a comprehensive water management programme to protect against unintentional releases.**

in full compliance with

**The operation is**

in substantial compliance with

**Standard of Practice 4.3**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 4.3; to implement a comprehensive water management programme to protect against unintentional releases.

The Auditors reviewed the Tarkwa Gold Mine site wide water balance prepared by Knight Piesold using the Goldsim software which is comprehensive and probabilistic. Goldsim, the software used for the water balance is a probabilistic software as it allows the inclusion of variability for the water balance parameters, such as precipitation, deposition rates, changes in areas with changes in facility geometry, etc. Monte Carlo simulation can also be undertaken to derive probability of occurrence for some specific chosen events.

The consideration of freezing and thawing is not relevant for Tarkwa Gold Mine as Ghana is located in a tropical zone.

The Goldsim model was reviewed and includes the rates at which solutions are/were applied to the north heap leach and south heap leach pads, as well at the rates and volumes of tailings deposited in each of the TSF areas.

The Goldsim model has been reviewed and includes the 1 in 100 year 24 hour rainstorm event with a value of 240 mm.

The Goldsim model has been reviewed and includes the rainfall records. The records are mainly sourced from the Tarkwa meteorological station and more recently by the mine weather station located north of the

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# ICMI CYANIDE RE-CERTIFICATION AUDIT - SUMMARY REPORT

TSFs. The recorded rainfall data covers the period 1939-2010. The rainfall data provided by TGM was collected from 1939-2005 by the school of metallurgy and mining and from 2005 by the Tarkwa Gold Mine Environmental Department from the weather station near the north heap leach facility.

The Goldsim model was reviewed and includes the following: different run off coefficients for the different facilities/vegetation type encountered; all internal and external catchment areas for all facilities considered in the water balance model; the tailings storage facilities characteristics (permeability of the basins, minimum and maximum pond volume allowed in the basin; all seepage characteristics (underdrainage, toe drain, face seepage are all taken into account); heap leach facility characteristics (runoffs coefficient and infiltrations, areas, volumes, and process characteristics).

The mine is currently not limited in its volume discharge into the environment by the EPA, although the discharge is effectively limited by the pump capacity and the daylight hours (as internal procedures require that the water is discharged via pump during daylight hours).

The operating procedures incorporate inspection and monitoring activities to implement the water balance and prevent overtopping of ponds and impoundments and unplanned discharge of cyanide solutions to the environment.

All TSF are operated with a freeboard of 1.5 m as stated in the operational manual, and the raise design and construction reports.

The operation measures precipitation, compares the results to design assumptions and revises operating practices as necessary.

**Standard of Practice 4.4: Implement measures to protect birds, other wildlife and livestock from adverse effects of cyanide process solutions.**

in full compliance with

The operation is

in substantial compliance with

**Standard of Practice 4.4**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 4.4; to implement measures to protect birds, other wildlife and livestock from adverse effects of cyanide process solutions.

All analytical results (from monitoring and titration) were reviewed from the metallurgical department and environmental department for the recertification period, and this covers the following: north heap leach ponds, south heap leach ponds, tailings storage area supernatant, as well as all process plant event pond, process pond and raw water pond, and containment ponds (5 ponds) and the two compliance points: River catchment area discharge pond, and SP2 (discharge after south heap leach). WAD cyanide levels in all open water on site has been below the 50 mg/l limit since the last audit except on two occasions. The two occurrences were on the Phase 4 pregnant pond of the north heap leach 26 august 2011 and in the phase 5 pregnant pond at the north heap leach 18 July 2014.

Wildlife mortality is reported to and recorded by the environmental department, and there has not been any cyanide related mortality since the previous recertification audit. This has been verified with personnel interviews as well as review of the TSF inspection, heap leach pond and solution corridor inspections, and a review of all the environmental department reports issued following a record of wildlife mortality.

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# ICMI CYANIDE RE-CERTIFICATION AUDIT - SUMMARY REPORT

North heap leach and south heap leach are no longer spraying cyanide solution onto the heap. The south heap leach is in the process of being decommissioned. The north heap leach is currently being sprayed with water that does not contain cyanide to flush out the solutions within the heap leach.

Normal stacking method used is the grasshopper deposition method without flattening the surface. The north heap leach did not exhibit any ponding although the water currently being sprayed on to the north heap leach does not contain cyanide.

When the heap leaches were fully operational netting was used in areas where ponds formed to prevent access by bird life.

**Standard of Practice 4.5: Implement measures to protect fish and wildlife from direct and indirect discharges of cyanide process solutions to surface water.**

in full compliance with

The operation is

in substantial compliance with

**Standard of Practice 4.5**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 4.5; to implement a comprehensive water management programme to protect against unintentional releases.

There is no direct discharge to surface water from the TSF area as all water is returned either to the plant, or to the clarifier, where it is then pumped to the detoxification plant at the north heap leach. It then enters the containment dam area and subsequently the River Catchment Area Discharge Pond. There is no direct discharge to the environment from the CIL plant, as verified during the site inspection. For the north heap leach, water is transferred to the containment dam area after detoxification, and subsequently to the compliance point River Catchment Area Discharge Pond (compliance point RCAD).

The detoxification reduces the WAD CN values to less than 0.05 ppm as per procedure TGM 3 7 30 03 PR: Decontamination of Sodium Cyanide Solution (Detox).

The environmental department measured free cyanide at the compliance points (RCAD and SP2) in 2011 and 2012, and have been measuring WAD cyanide and free cyanide since 2013.

Ghana EPA designates water quality standards of 0.2 ppm free CN and 0.6 ppm WAD CN before permitting release into the stream. The site has an internal metallurgical standard of 0.05ppm free CN before release.

There are three occurrences when levels were higher than the 0.022 mg/l free cyanide limit: SP2 May 2011 0.023 mg/l, SP2 October 2011 0.024 mg/l, and SP2 April 2012 0.059 mg/l. These were isolated incidents at the discharge associated with the south heap leach where cyanide addition ceased in October 2012 and is currently being decommissioned.

There is no indirect discharge to the surface water, auditors reviewed the free and WAD cyanide value for 2011, 2012, 2013 and 2014 for the entire set of monitoring data mine wide and the results from streams, monitoring boreholes do not indicate presence of significant cyanide values.

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**Standard of Practice 4.6: Implement measures designed to manage seepage from cyanide facilities to protect the beneficial uses of groundwater.**

in full compliance with

The operation is

in substantial compliance with

**Standard of Practice 4.6**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 4.6; to implement measures designed to manage seepage from cyanide facilities to protect the beneficial uses of groundwater.

The operation implements specific water management measures to manage seepage to protect the beneficial uses of groundwater beneath and/or immediately down-gradient of the operation.

A series of boreholes have been installed and are being monitored to establish whether any seepage to groundwater is occurring. Underdrains and toe drains are constructed at the TSFs and all seepage intercepted is pumped back onto the TSF. The drains and pumps are checked during the daily inspections

The new TSF 5 will be constructed with an artificial impermeable liner on the floors and the walls of the dam.

Floor of the leach pad, solution corridors, and ponds were constructed with impermeable HDPE material to minimize seepage flow into groundwater. Monitoring boreholes were provided and monitored to provide an early warning in the event of any seepage occurring.

Groundwater is extracted from the creek system some distance away from the TSF and heap leach pads. Beneficial use is nominal drinking water by communities. Ghanaian EPA cyanide levels guidelines for effluent water are 0.2 ppm free CN and 0.6 ppm WAD CN, and for drinking water is 0.01 ppm free CN.

The free cyanide concentration for the 31 boreholes located around the TSFs and heap leach areas (NBH 01 to 04, 09, 13 to 24, 26, 30 to 32, 34 to 40 and 42 to 44) were reviewed for the period 2011-2014 and indicate low concentrations of free CN complying with local legislation.

The mine does not use mill tailings ad underground backfill.

**Standard of Practice 4.7: Provide spill prevention or containment measures for process tanks and pipelines.**

in full compliance with

The operation is

in substantial compliance with

**Standard of Practice 4.7**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 4.7; Provide spill prevention or containment measures for process tanks and pipelines.

The storage and mixing areas are installed on concrete foundation and located inside concrete bunds which are of adequate capacity to take 110% of the volume of the tanks.

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The auditors verified during the site inspections that the secondary containments are in adequate conditions for the purpose of holding the contents of the tanks.

The CIL tanks are located within a concreted secondary containment area with concrete floors and bunds in adequate condition. If the CIL bund were to overflow this would flow to the event pond, located just outside the plant area and which is fully lined.

Procedures in place and being implemented to prevent discharge to the environment or any cyanide solution or cyanide-contaminated water that is collected in the secondary containment area. The TSF is equipped with pipeline to detox excess return solution at the north detox facility. For the CIL mixing, storage and leaching facilities, all bunded areas are equipped with sumps and sump pumps for solution collection and preventing discharging into the environment. The solutions being pumped back in to the CIL tanks.

All cyanide process tanks are equipped with secondary containment.

The tailings pipelines and return water lines are placed inside concrete channels draining back to the plant or inside earth channels draining into the TSF valley area in case of leaks.

All other process pipeline are located inside the plant area, either above the concrete bund area or within concrete spillage channel.

During the site inspection, the auditors confirmed that there was no area where the cyanide pipeline could present a risk to surface water and therefore no special protection needs are required.

Site inspection provided verification that tanks and pipes within the CIL plant, tailings pipelines, and return water pipelines are manufactured from mild steel or HDPE and therefore compatible with cyanide and high pH conditions.

**Standard of Practice 4.8: Implement quality control/quality assurance procedures to confirm that cyanide facilities are constructed according to accepted engineering standards and specifications.**

in full compliance with

The operation is

in substantial compliance with

Standard of Practice 4.8

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 4.8; to implement quality control/quality assurance procedures to confirm that cyanide facilities are constructed according to accepted engineering standards and specifications.

Quality control and quality assurance programs have been implemented during construction of all new cyanide facilities and modifications to existing facilities, including cyanide unloading, storage, mixing facilities and other cyanide facilities.

The initial certification audit and subsequent re-certification audit detailed all of the quality control and quality assurance programs for the construction of the original cyanide facilities.

During the period since the last audit the following new cyanide facilities or modifications to existing facilities has been as follows:

Commissioning of TSF 3;

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Construction of TSF raises: TSF 2 stage 3 and stage 4 in progress, TSF 1 stage 6 and 7;

Replacement of mixing tank in external reagent area; and

Replacement of storage tank in CIL storage area.

Cyanide spraying was stopped on south heap leach in October 2012, and on the north heap leach in September 2014

The replacement of the CIL mixing and storage tanks quality assurance was provided by Seedco Engineering and Construction, the auditor reviewed the certificate of compliance, the radiographic testing report as well as the inspection and test certificate that the facility complies in all respect with the mining regulations.

The construction report for the commissioning of TSF 3 as well as for the construction of all raises were reviewed during the audit, as well as the quarterly reports and annual reports for the TSF and the EPA authorisation to use the facilities.

**Standard of Practice 4.9: Implement monitoring programs to evaluate the effects of cyanide use on wildlife, surface and groundwater quality.**

in full compliance with

The operation is

in substantial compliance with

**Standard of Practice 4.9**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 4.9; to implement monitoring programs to evaluate the effects of cyanide use on wildlife, surface and groundwater quality.

The operation has developed written standard procedures for monitoring activities. The sampling and analytical protocol has been developed by the Environmental Superintendent, who has an MSc degree in Environmental Chemistry from the University of Sciences from Kumasi and more than 15 years experience in environmental management.

Procedures specify how and where samples should be taken, sample preservation techniques, chain of custody procedures, shipping instructions, and cyanide species to be analysed.

The Auditors reviewed procedure TGM-ENV-Env-01 dated 30/04/2014 Procedure Water Quality Monitoring and Quality Assurance Program, which includes sample preparation, procedures, purging, preservation, storage, submission, quality control, record keeping and reporting for surface and groundwater sampling.

Reviewed the SGS book for 2014 for samples submission sheets that contains the following information: client details, dispatch details, sample details, sample preparation details, report format, analyses required, and sample disposal instructions.

Samples are analysed for WAD (since 2013) and free cyanide at the in house environmental laboratory. The SGS Tema Laboratory is analysing the samples for free and WAD cyanide on a monthly basis at the two compliance points RCAD and SP2. These samples are taken by SGS.

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Sampling conditions (e.g., weather, livestock/wildlife activity, anthropogenic influences, etc.) and procedures are documented in writing. The operation monitors for cyanide in discharges of process water to surface water and in surface and groundwater down-gradient of the site. The operation inspects for and records wildlife mortalities related to contact with and ingestion of cyanide solutions. No wildlife mortalities related to cyanide have been found during the recertification period.

All environmental monitoring is conducted at monthly intervals for all water monitoring points (covers streams, groundwater, heap leaches ponds, potable water and community wells), but monitoring on process water by the metallurgical department is done several times daily (cyanide addition), or weekly (WAD in TSF water or process ponds, reclaim water)

Wildlife mortality is checked daily using checklist (TSF, heap leach). This monitoring pattern is considered adequate by the Auditors to characterise the medium being monitored and to identify changes in a timely manner.

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PRINCIPLE 5 – DECOMMISSIONING

Manage Cyanide Process Solutions and Waste Streams to Protect Human Health and the Environment

Standard of Practice 5.1:

Plan and implement procedures for effective decommissioning of cyanide facilities to protect human health, wildlife and livestock.

[X] in full compliance with

The operation is

[ ] in substantial compliance with

Emergency Response Practice 5.1

[ ] not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in full compliance with Standard of Practice 5.1; to plan and implement procedures for effective decommissioning of cyanide facilities to protect human health, wildlife and livestock.

The operation has developed written procedures to decommission cyanide facilities at the cessation of operations including the following: TGM 3 0 025 PR Plant Procedure Decommissioning of Cyanide Equipment / Facility dated rev 13 November 2013. This includes the decommissioning tasks as well as decommissioning schedule; TGM 3 7 30 13 PR Decommissioning of Sodium Cyanide Solution Ponds dated 12 November 2013; and TGM3 9 48 06 PR - Decommissioning of Tailings Storage Facilities dated 29 January 2014.

The Costed Mine Closure and Reclamation Plan 2014-2017 Tarkwa Gold Mine, dated February 2014, Golder Associates was reviewed by Mark Montoya, Visus Consulting Group Inc. This presents a preliminary schedule of the decommissioning activities distinguishing between the operational period pre-closure activities (1-2 years prior to cessation of operations), the decommissioning period, which may last 2 to 5 years after cessation of operation, and the post closure activities starting three years after cessation of activities and lasting indefinitely.

The closure and reclamation plans have been produced and updated regularly. The auditors verified the Metago SLR 2011 Closure and Reclamation Plan, which updated the June 2006 Metago Closure and Reclamation Plan; and the Costed Mine Closure and Reclamation Plan 2014-2017 Tarkwa Gold Mine, dated February 2014, Golder Associates, reviewed by Mark Montoya (Visus Consulting Group Inc.).

The specific decommissioning procedures (part of the SOP systems) are being revised every two years or as necessary.

Standard of Practice 5.2:

Establish an assurance mechanism capable of fully funding cyanide related decommissioning activities.

[X] in full compliance with

The operation is

[ ] in substantial compliance with

Standard of Practice 5.2

[ ] not in compliance with

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The operation is in full compliance with Standard of Practice 5.2; to establish an assurance mechanism capable of fully funding cyanide related decommissioning activities.

The operation has developed an estimate of the cost to fully fund third party implementation of the cyanide-related decommissioning measures as identified in its site decommissioning or closure plan including the following: Costed Mine Closure and Reclamation Plan 2014-2017 Tarkwa Gold Mine, dated February 2014, Golder Associates, reviewed by Mark Montoya (Visus Consulting Group Inc; Decommission and reclamation of the north heap leach facilities, dated March 2014, African Environmental Research and Consulting Company; Decommission and reclamation of the south heap leach facilities, dated October 2013, African Environmental Research and Consulting Company; and Metago, 2011 Closure and Reclamation Plan,

The review by Visus Consulting Group Inc. confirmed the Golder Closure Plan contains a spreadsheet detailing the costs associated with the closure and reclamation of the entire Tarkwa Gold Mine, in case of both planned and unplanned closure, and which details, amongst other things, the costs for decommissioning the cyanide facilities including in the main areas such as the heap leach pads; the ADR plant, the CIL plant, the ponds, the TSFs, and the post closure aspects. It is clear from the costing spreadsheet that the costs have been calculated for a third party contractor implementation of the plan and that it includes adequate funds for cyanide related decommissioning activities.

The costs estimates from the closure and reclamation plan are reviewed internally and updated every year, and every other year the updated costs estimates are sent to the authorities. The operation has established a financial mechanism approved by the applicable jurisdiction to cover the estimated costs for cyanide-related decommissioning activities as identified in its decommissioning and closure strategy.

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**PRINCIPLE 6 – WORKER SAFETY**

**Protect Workers’ Health and Safety from Exposure to Cyanide**

**Standard of Practice 6.1: Identify potential cyanide exposure scenarios and take measure as necessary to eliminate, reduce and control them.**

**in full compliance with**

**The operation is**

in substantial compliance with

**Standard of Practice 6.1**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 6.1; to identify potential cyanide exposure scenarios and take measure as necessary to eliminate, reduce and control them.

Goldfields Gold Mine has developed procedures describing how cyanide-related tasks such as unloading, mixing, plant operations, entry into confined spaces, and equipment decontamination prior to maintenance should be conducted to minimize worker exposure.

This includes 30 Cyanide Procedures - General, 52 Cyanide Procedures - CIL, 22 Cyanide Procedures HL, and 6 Special Cyanide Procedures - General.

The Auditors confirmed that the procedures include the use of PPE and address pre-work instructions.

There is a Change Management Procedure for the mine TGM 9 14 PR Rev.1, dated 25 August 2010. The change management process includes any additions to the mining process that is managed by the mine. Any major changes are managed by the head office and implemented by the head office due to the size of the change. There have not been any major changes associated with the storage, mixing or processing of cyanide.

The Senior Safety Officer - Metallurgy described how worker input is solicited during the creation of a new procedure. Once a draft procedure has been created this is distributed to the whole workforce in order to obtain feedback. The Procedure is then finalised taking in to account any feedback before it is sent to the training department for the relevant personnel to be trained in the procedure.

Monthly Health and Safety Meetings are held for each department. There is an opportunity for individuals to provide any input regarding health and safety procedures at these meetings. In addition individuals are trained on specific procedures, training matrix and excel spreadsheet were observed showing the individual procedures and who are required to be and have been trained on them. Workers have the opportunity when being trained on these procedures to provide feedback to the Training Superintendent, who is also involved in the creation of the procedures.

**Standard of Practice 6.2: Operate and monitor cyanide facilities to protect worker health and safety and periodically evaluate the effectiveness of health and safety measures.**

**in full compliance with**

**The operation is**

in substantial compliance with

**Standard of Practice 6.2**

not in compliance with

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### Summarise the basis for this Finding/Deficiencies Identified:

The operation is in full compliance with Standard of Practice 6.2; to operate and monitor cyanide facilities to protect worker health and safety and periodically evaluate the effectiveness of health and safety measures.

The operation has determined the appropriate pH for limiting the evolution of HCN gas during mixing and production activities.

The Auditors observed the Sodium Mixing Start Up Procedure TGM 3 9 60 03 PR Rev 7 dated 10 April 2014, specifying the pH to be >10.5. There is currently no mixing at the south heap leach (ceased October 2012) or the north heap leach (ceased September 2014). However, the procedure for Sodium Cyanide Mixing (ADR) TGM 3 7 40 14 PR Rev 4 dated 30 Sept 2014, was reviewed, which stated that the pH for the mixing tanks at the south and north heap leach is to be 10.5.

Within the CIL the pH in the leach tanks is measured in the first leach tank (Common Tank) with a continuous monitor and by manual titration three times per shift. The set point for the pH is 10.5 (pers comm.) This is also specified in procedure CIL Train 2 Circuit Start Up TGM 3 9 41 01 PR Rev 4 dated 27 Feb 2014.

The operation uses ambient monitoring devices at locations that have been identified as cyanide hotspots. This includes on top of the Leach Tanks, the Cyanide Storage Tank at the CIL, the Cyanide Mixing Tank for the CIL and the Cyanide Mixing Tanks for the South and North Heap Leach facilities (although the mixing tanks at the Heap Leach Facilities are no longer operational). In addition personal monitors are used e.g. during the mixing operation and during the cleaning of the Leach Tanks bund. These were observed during the site visit. The alarms on all of the monitors are set at 4.7 for first alarm whereby the operator should cease activities and leave the area. The second alarm is set at 10 ppm and gives rise to instant evacuation. This is detailed on the notice boards in these areas and from personal communication.

The personal hydrogen cyanide gas monitors (Pac 7000 and X-AM 5600) the fixed hydrogen cyanide gas monitors (Polytron 7000) are serviced every 6 months.

Warning signs have been observed showing that eating, drinking, smoking, and open flames are not allowed and that the appropriate PPE should be worn at; the cyanide mixing facility for the CIL Plant, the cyanide storage tank at the CIL Plant, and the top of the Leach Tanks at the CIL Plant.

Emergency showers with integrated low pressure eye washes are located at the mixing facility for the CIL Plant, the cyanide storage tanks for the CIL Plant and on top of the Leach Tanks at the CIL Plant. There were also emergency showers and low pressure eye washes at the mixing facility for the North Heap Leach although mixing of cyanide ceased on the 30 September 2014. Dry powder fire extinguishers were also observed at all these locations.

The reagent strength cyanide mixing and storage tanks and associated piping is coloured purple to demonstrate that they contain cyanide. The piping is also labelled 'Cyanide' and the direction of flow indicated. The pipelines containing tailings from the CIL Plant are labelled as 'slurry' with the direction of flow and which TSF the pipe is going to.

The operational language for the mine and CIL Plant is English in written and verbal communications. This was confirmed through interviews. The MSDS and first aid procedures are located in the office/first aid room adjacent to the cyanide mixing area, in the first aid room adjacent to the cyanide solution storage tanks, on the first aid cabinet on top of the Leach Tanks, and on staff notice boards. It was also observed at the North Heap Leach mixing plant, although that plant ceased operation on 30 Sept 2014.

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There have been no cyanide exposure incidents in the last three years. If an incident did occur it would be investigated in accordance with Conducting Cyanide Emergency Drill and Incident Investigation procedure TGM 3 0 0003 PR, Rev 5, dated 9 September 2014.

**Standard of Practice 6.3: Develop and implement emergency response plans and procedures to respond to worker exposure to cyanide.**

in full compliance with

The operation is

in substantial compliance with

**Standard of Practice 6.3**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 6.3; to develop and implement emergency response plans and procedures to respond to worker exposure to cyanide.

The operation has water, oxygen, radio and antidote at the emergency first aid stations at the cyanide storage facility for the CIL Plant, the top of the Leach Tanks and the Cyanide Mixing and Storage Facility for the CIL plant (this used to include the mixing facilities for the South and North Heap Leach facilities but the cyanide mixing facilities at these locations are no longer used). The oxygen includes a valved mouth piece that can be used as a resuscitator. These locations also include Man Down alarms and alarmed emergency showers.

First aid equipment checked monthly by Safety Officer and daily by shift staff. The Auditors reviewed monthly checklists. The Auditors also verified that cyanide antidote kits are stored as per manufacturer recommendations. Ordering of antidote is done via the SAP system prompting for orders in time. All antidote kits were within the expiry date.

The operation has a Sodium Cyanide First Aid Procedure TGM 3 0 002 PR Rev 5 dated 9 Sept 2014. This procedure includes the first aid to be provided, the administration of the antidote (only by trained hospital medical staff) and transportation of the patient to hospital. The Gold Mine has individuals on each shift trained in first aid. In addition they have an Emergency Response Team that includes three people trained in first aid plus a paramedic for each shift (2 x 12 hour shifts). The Emergency Medical Response Team will respond to any cyanide emergency and will transport the patient by ambulance to the on site hospital. The on site hospital is operated by International SOS under contract to Goldfields. . If subsequently they require specialist treatment they will be medivaced to the necessary hospital in Accra, Ghana or if necessary to an international facility.

The Gold Mine has an on-site hospital that are aware of the potential need to treat patients for cyanide exposure and the operation has assured that the medical facility has adequate, qualified staff and equipment and expertise to respond to cyanide exposures. The chief Medical Officer and the Hospital Manager were interviewed together with the Physician's Assistant (specialist nurse) confirming the actions to be undertaken in the event of a cyanide exposure. The mine provides cyanide awareness training to the medical staff. The Protocol for Treatment with cyanokit was observed. The equipment within the emergency medical room was also observed including the availability of full PPE, oxygen and cyanokit. Mock emergency drills are conducted every 6 months to test response procedures for various exposure scenarios. This included man down drills and environment spills. The report on the drill includes corrective and preventative actions.

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**PRINCIPLE 7 – EMERGENCY RESPONSE**

**Protect Communities and the Environment through the Development of Emergency Response Strategies and Capabilities**

**Standard of Practice 7.1: Prepare detailed emergency response plans for potential cyanide releases.**

in full compliance with

**The operation is**

in substantial compliance with

**Standard of Practice 7.1**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 7.1; to prepare detailed emergency response plans for potential cyanide releases.

The Gold Mine has a Cyanide Emergency Response Plan TGM 3 0038 PR Rev 4 dated 23 July 2014. In addition there is a general mine Emergency Preparedness and Response Procedure TGM ENV PRO 011, Rev 5 dated 13 Dec 2012, and a specific environmental Emergency Response Preparedness Procedures TGM-ENV-SW-011, Rev 4, Dated 30 April 2014. These address the potential releases of cyanide that may occur or require response.

The Plan considers the potential cyanide failure scenarios appropriate for its site-specific environmental and operating circumstances. Transport related emergencies outside the mine are the responsibility of Orica as manager of the supply chain.

The Plan describes various response actions as appropriate for the anticipated emergency situations. This includes checking wind direction, entry control to the affected area, communication with relevant people internally, cessation of operations, containment of spill etc. as required, neutralisation of any cyanide solution and cleaning up of spill. It notes that if cyanide has entered the patient’s body the antidote is held at the first aid room but only a medical officer may administer it. First aid is detailed in Sodium Cyanide First Aid Procedure TGM 3 0 002 PR Rev 5, dated 9 Sept 2014. The assessment and mitigation and future prevention of releases is detailed in Conducting Cyanide Emergency Drill and Incident Investigation TGM 3 0 003 PR Rev 5, 9 Sept 2014. There have not been any cyanide incidents in the last 3 years.

**Standard of Practice 7.2: Involve site personnel and stakeholders in the planning process.**

in full compliance with

**The operation is**

in substantial compliance with

**Standard of Practice 7.2**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 7.2; to involve site personnel and stakeholders in the planning process.

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The workforce are included in the emergency response planning process through the Monthly health and safety meetings and through the testing of the Emergency response plan by the mock drills. Due to the size of the mine and the location of the nearest community is Tarkwa Town (approximately 5 km from the cyanide storage, mixing and process areas) communities are not directly involved in the emergency response planning process

Quarterly consultative meetings held with local communities including chiefs, and government officials including EPA, public affairs officials, district assembly persons, etc. This is called the Community Consultative Committee (CCC). The meeting held on the 1 October 2014 include a presentation by the Metallurgical Plant Health and Safety Representative and a representative from the EPA on cyanide awareness. This provides an opportunity for the external stakeholder to raise any concerns regarding the management of cyanide. There are additional mechanisms for interaction with the local community on a more informal basis with the Community Affairs Department of 5 people interacting with the surrounding communities. This includes a radio program on "Space FM" cyanide issues, precautions, and the role of EPA on cyanide. In addition the minutes from a Community Health Facilitators Review Meeting dated 7 May 2015, which included a cyanide awareness presentation. These meetings and presentations are undertaken in the local Akan language.

In addition anybody can make a complaint to the operation. The Community Affairs Department maintain the complaints register was observed with the last complaint being on the 9 October 2014. No complaints were observe to be related to cyanide.

The main response agencies are the Emergency Medical Response Team, the Fire Response Team, and the on-site hospital. These have all been involved in the emergency planning and response process.

The operation engages in communication with stakeholders to keep the Emergency Response Plan current. The most recent communication was through the mock drill on the 19 September 2014 which involved the Emergency Medical Response Team, the on-site hospital, and the staff of the CIL Plant.

**Standard of Practice 7.3: Designate appropriate personnel and commit necessary equipment and resources for emergency response.**

in full compliance with

**The operation is**

in substantial compliance with

**Standard of Practice 7.3**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 7.3; to designate appropriate personnel and commit necessary equipment and resources for emergency response.

Cyanide Emergency Response Plan TGM 3 0038 PR Rev 4 dated 23 July 2014 Section 1.0 defines the response co-ordinators (Emergency Controller and Site Controller) roles and responsibilities. The Emergency Controller can "request the resources and people as dictated by the situation".

The Emergency Response Team is identified in Section 1.0 of the Cyanide Emergency Response Plan TGM 3 0038 PR Rev 4 dated 23 July 2014. Any member of a shift can be a first responder to a cyanide incident as they have all been trained in cyanide emergency response during the initial induction and subsequent refreshers.

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Any member of a shift can be a first responder to a cyanide incident as they have all been trained in cyanide emergency response during the initial induction and subsequent refreshers. The Emergency Response Medical Team are trained by St John 's Ambulance in Advanced First Aid. The certificate for the Senior Safety Officer was observed showing that he is certified to be a trainer. The Health Professions Council of South Africa certificate was observed demonstrating the Paramedic is suitably registered together with a National Diploma in Emergency Medical Care from the Cape Peninsula University of Technology, South Africa. The permanent members of the Fire Brigade Team, 3 per shift, as sent to Accra for training on an annual basis.

The Emergency Preparedness and Response Procedure TGM ENV PRO 011 Rev 5 dated 13 December 2012 provides an Emergency Contact List - Appendix 3 including internal and external responders.

The Cyanide Emergency Response Plan TGM 3 0 0038 Rev 5 dated 23 July 2014 specifies the duties and responsibilities of the Emergency Controller, Site Controller and Plant Supervisor in the event of an emergency involving cyanide.

The Cyanide Emergency Response Plan TGM 3 0 0038 Rev 5 dated 23 July 2014 lists the Emergency Response equipment including PPE on-site.

The Cyanide Emergency Response Plan TGM 3 0 0038 Rev 5 dated 23 July 2014 specifies that the emergency response equipment kept in the Emergency Response Trailer is inspected weekly and recorded on a checklist. The emergency trailer is located next to the cyanide storage and mixing area for the CIP. The checklist was observed.

In the event of a cyanide emergency incident The Cyanide Emergency Response Plan TGM 3 0 0038 Rev 5 dated 23 July 2014 states that the Emergency Response Personnel must be contacted who will organise for the patient to be transferred to the on site hospital and inform the hospital that the patient is in transit via the on site ambulance. The patient will only be medivaced to another facility in Accra once it has been determined what further treatment is required. The on site hospital is equipped to provide full treatment in the event of a cyanide incident.

Due to the location of the Plant within the mine and the distance from appropriately equipped outside entities the responders in the event of an emergency on the mine are restricted to the mine's emergency response teams and the on site hospital., all of who are included in mock emergency drills.

**Standard of Practice 7.4: Develop procedures for internal and external emergency notification and reporting.**

in full compliance with

The operation is

in substantial compliance with

Standard of Practice 7.4

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 7.4; to develop procedures for internal and external emergency notification and reporting.

The Emergency Preparedness and Response Procedure includes procedures for notifying management, the Emergency Medical Response Team, the on site hospital, and internal Fire Brigade. It also states how all

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# ICMI CYANIDE RE-CERTIFICATION AUDIT - SUMMARY REPORT

external communication is to be undertaken including local communities, Ghana police service and Ghana Environmental Protection Agency.

**Standard of Practice 7.5: Incorporate into response plans and remediation measures monitoring elements that account for the additional hazards of using cyanide treatment chemicals.**

in full compliance with

The operation is

in substantial compliance with

**Standard of Practice 7.5**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 7.5; to incorporate in response plans and remediation measures monitoring elements that account for the additional hazards of using cyanide treatment chemicals.

The Cyanide Emergency Response Plan describes specific remediation measures including the recovery or neutralisation of solutions and solids (section 4.0, 5.1 and 5.2); decontamination for soils and other contaminated media (Section 4.2, 5.1 and 5.2); management and disposal of spill clean up (section 4.2) and raw water is obtained from groundwater sources. In addition it prohibits the use of chemicals such as sodium hypochlorite, ferrous sulphate and hydrogen peroxide to treat cyanide that has been released into surface water. It also addresses the potential need for environmental monitoring to identify the extent and effects of a release, taking samples to test for free cyanide, WAD cyanide and pH.

The protocol for water monitoring ins contained in Water Quality Monitoring and Quality Assurance Program, TGM-ENV-Env- 01, Rev 3 dated 30 April 2014.

Provision of alternate drinking water supply is not required as local surface water is not in proximity to where process solution strength cyanide solution is used, solid cyanide is stored or the TSF is located.

**Standard of Practice 7.6: Periodically evaluate response procedures and capabilities and revise them as needed.**

in full compliance with

The operation is

in substantial compliance with

**Standard of Practice 7.6**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 7.6; to periodically evaluate response procedures and capabilities and revise them as needed.

The Emergency Preparedness and Response Procedure states that the Emergency Management System will be reviewed annually. In addition "Heads of Department are responsible for the identification and management of the emergency plan within their areas of responsibility. They will advise the Environment,

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Health and Safety and Security Managers of any changes that occur in their areas of responsibility including changes in equipment or other issues that may affect the implementation of this procedure."

Mock emergency drills are conducted every 6 months to test response procedures for various exposure scenarios. There have been no cyanide related emergencies within the last three years. The Emergency Preparedness and Response Procedure TGM ENV PRO 011 rev 5 dated 13 Dec 2012 states that emergency preparedness and response procedures will be reviewed after every major incident or drill.

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**PRINCIPLE 8 – TRAINING**

**Train Workers and Emergency Response Personnel to Manage Cyanide in a Safe and Environmentally Protective Manner**

**Standard of Practice 8.1: Train workers to understand the hazards associated with cyanide use.**

in full compliance with

**The operation is**

in substantial compliance with

**Standard of Practice 8.1**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 8.1; to train workers to understand the hazards associated with cyanide use.

All personnel on the mine are trained in cyanide hazard recognition through the initial induction for the mine. More detailed cyanide training is provided for those individuals who are likely to encounter cyanide. There is a training matrix showing the training that is required for the different area of the mine e.g. Leaching. In addition there is an excel spreadsheet that was observed that details the training undertaken by all named personnel with the date that the training is undertaken. It was observed that all personnel had been provided with Induction training that includes ICMI Cyanide Awareness.

The ICMI Cyanide Awareness Training that is provided to all individuals is refreshed on a periodic basis (i.e. when individuals return from annual leave, approximately every 12 months) for those personnel that may encounter cyanide. This includes personnel working in the following areas as shown on the training matrix; Leaching, Elution, TSF, Reagents (inc. storage and mixing of cyanide), Gold Room, ER Team, and Metallurgical Team.

All training records including those regarding cyanide training are retained.

**Standard of Practice 8.2: Train appropriate personnel to operate the facility according to systems and procedures that protect human health, the community and the environment.**

in full compliance with

**The operation is**

in substantial compliance with

**Standard of Practice 8.2**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 8.2; to train appropriate personnel to operate the facility according to systems and procedures that protect human health, the community and the environment.

The operation trains workers to perform their normal production tasks, including unloading, mixing, production and maintenance with minimum risk to worker health and safety and in a manner that prevents unplanned cyanide releases. This includes undertaking formal training in specific procedures. The training

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elements/procedures for each job are identified for each area/ team on the training matrix. The Training Matric then generates an excel spreadsheet showing the training that is undertaken for each individual.

Joseph Kwofie and Benedicta Asafo-Adjei the Metallurgical Training Superintendent and the Metallurgical Training Officer undertake the majority of the formal training. The training record for both were observed and show that they are appropriately qualified. All personnel on the mine are trained in cyanide hazard recognition through the initial induction for the mine. More detailed cyanide training is provided for those individuals who are likely to encounter cyanide. There is a training matrix showing the training that is required for the different areas of the mine e.g. Leaching. In addition there is an excel spreadsheet that was observed that details the training undertaken by all named personnel with the date that the training is undertaken. It was observed on the excel spreadsheet that all personnel had been provided with Induction training that includes ICMI Cyanide Awareness.

The ICMI Cyanide Awareness Training that is provided to all individuals is refreshed on a periodic basis ( i.e. when individuals return from annual leave, approximately every 12 months) for those personnel that may encounter cyanide. This includes personnel working in the following areas as shown on the training matrix; Leaching, Elution, TSF, Reagents (inc. storage and mixing of cyanide), Gold Room, ER Team, and Metallurgical Team.

PTOs are undertaken to evaluate the effectiveness in the training of the various procedures. Records retained throughout an individual's employment documenting the training they have received and including the names of the employee and the trainer, the date of training, the topics covered, and how the employee demonstrated an understanding of the training materials.

**Standard of Practice 8.3: Train appropriate workers and personnel to respond to worker exposures and environmental releases of cyanide.**

in full compliance with

The operation is

in substantial compliance with

**Standard of Practice 8.3**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 8.3; to train appropriate workers and personnel to respond to worker exposures and environmental releases of cyanide.

The Cyanide Induction Training and Refresher Training includes training in the procedures to be followed if cyanide is released. The refresher training is undertaken when individuals return from annual leave, approximately every 12 months, for those personnel that may encounter cyanide. This includes personnel working in the following areas as shown on the training matrix; Leaching, Elution, TSF, Reagents (inc. storage and mixing of cyanide), Gold Room, ER Team, and Metallurgical Team.

All cyanide unloading, mixing, production and maintenance workers trained in decontamination and first aid procedures as part of the initial Cyanide Induction for mine workers and during the Refresher Training for individuals in the following teams; Leaching, Elution, TSF, Reagents (inc. storage and mixing of cyanide), Gold Room, ER Team, and Metallurgical Team.

All members of the teams are trained in procedures included in the Emergency Response Plan, including the use of necessary response equipment as part of the Cyanide Induction Training and Refresher Training.

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Quarterly consultative meetings held with local communities including chiefs, and government officials including EPA, public affairs officials, district assembly persons, etc. This is called the Community Consultative Committee (CCC). The meeting held on the 1 October 2014 include a presentation by the Metallurgical Plant Health and Safety Representative and a representative from the EPA on cyanide awareness including the actions to be undertaken in an emergency. This provides an opportunity for the external stakeholders including off site emergency responders to raise any issues regarding the Emergency Response Plan.

Mock emergency drills are conducted every 6 months to test response procedures for various exposure scenarios. Emergency Drill Reports were observed this included man down drills and environment spills. The Drill on the 19 September was undertaken to test the response of the Emergency Response Team, the International SOS personnel at the hospital and the evacuation of the entire CIL Plant workforce.

Cyanide emergency drills are evaluated from a training perspective to determine if personnel have the knowledge and skills required for effective response.

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PRINCIPLE 9 – DIALOGUE

Engage in Public Consultation and Disclosure

Standard of Practice 9.1: Provide stakeholders with the opportunity to communicate issues of concern.

[X] in full compliance with

The operation is

[ ] in substantial compliance with

Standard of Practice 9.1

[ ] not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation provides the opportunity for stakeholders to communicate issues of concern regarding the management of cyanide.

Quarterly consultative meetings held with local communities including chiefs, and government officials including EPA, public affairs officials, district assembly persons, etc. This is called the Community Consultative Committee (CCC). The meeting held on the 1 October 2014 include a presentation by the Metallurgical Plant Health and Safety Representative and a representative from the EPA on cyanide awareness. This provides an opportunity for the external stakeholder to raise any concerns regarding the management of cyanide. There are additional mechanisms for iteration with the local community on a more informal basis with the Community Affairs Department of 5 people interacting with the surrounding communities. This includes a radio program on "Space FM" cyanide issues, precautions, and the role of EPA on cyanide. In addition the minutes from a Community Health Facilitators Review Meeting dated 7 May 2015, which included a cyanide awareness presentation. These meetings and presentations are undertaken in the local Akan language. In addition anybody can make a complaint to the operation. The Community Affairs Department maintain the complaints register was observed with the last complaint being on the 9 October 2014. No complaints were observed to be related to cyanide.

Standard of Practice 9.2: Initiate dialogue describing cyanide management procedures and responsively address identified concerns.

[X] in full compliance with

The operation is

[ ] in substantial compliance with

Standard of Practice 9.2

[ ] not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in full compliance with Standard of Practice 9.2; to initiate dialogue describing cyanide management procedures and responsively address identified concerns.

Quarterly consultative meetings held with local communities including chiefs, and government officials including EPA, public affairs officials, district assembly persons, etc. This is called the Community Consultative Committee (CCC). The meeting held on the 1 October 2014 include a presentation by the Metallurgical Plant Health and Safety Representative and a representative from the EPA on cyanide awareness. This provides an opportunity for the external stakeholder to raise any concerns regarding the management of cyanide. There are additional mechanisms for iteration with the local community on a more informal basis with the Community Affairs Department of 5 people interacting with the surrounding

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communities. This includes a radio program on "Space FM" cyanide issues, precautions, and the role of EPA on cyanide. In addition the minutes from a Community Health Facilitators Review Meeting dated 7 May 2015, which included a cyanide awareness presentation. These meetings and presentations are undertaken in the local Akan language. In addition anybody can make a complaint to the operation. The Community Affairs Department maintain the complaints register was observed with the last complaint being on the 9 October 2014. No complaints were observed to be related to cyanide.

**Standard of Practice 9.3: Make appropriate operational and environmental information regarding cyanide available to stakeholders.**

in full compliance with

The operation is

in substantial compliance with

**Standard of Practice 9.3**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The operation is in full compliance with Standard of Practice 9.3; to make appropriate operational and environmental information regarding cyanide available to stakeholders.

The operation developed written descriptions of how their activities are conducted and how cyanide is managed, and made these descriptions available to communities and other stakeholders.

The main form of communication with surrounding communities is in a verbal format by the 5 members of the Community Affairs Department due to the high level of illiteracy in the local area. This includes quarterly consultative meetings with the CCC, meetings with the Community Health Facilitators, local radio programme, school visits to the mine, and other information discussions with the community. A Public Consultation and Disclosure Plan for Cyanide Management has been drafted and is currently with the interdepartmental committee to sign off on it showing all of the public consultation that is undertaken by the mine.

No cyanide incidents have occurred in the last 3 years. The Community Affairs Manager and the Metallurgical Training Superintendent confirmed that there has been no incident requiring interaction with the communities around the mine in the last 9 years i.e. since the mine has been certified with ICMI.

Any incident of cyanide exposure that results in hospitalisation or fatality, releases off the mine site that require response or remediation, releases on or off the mine site resulting in significant adverse effects to health or the environment, releases off the mine site requiring reporting under applicable regulations, or releases that cause exceedance of applicable limits for cyanide have to be reported to the EPA. There have not been any such incidents or events in the last 3 years.

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## Report Signature Page

**GOLDER ASSOCIATES AFRICA (PTY) LTD.**

A handwritten signature in black ink, appearing to read 'Ed Perry'.

Ed Perry  
Lead Auditor

A handwritten signature in blue ink, appearing to read 'Romain Girard'.

Romain Girard  
Gold Mine Auditor

Date: 18 May 2015

EP/RG/ag

Reg. No. 2002/007104/07

Directors: SA Eckstein, RGM Heath, SC Naidoo, GYW Ngoma

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